APPENDIX C: THE DEMAND FOR AND SUPPLY OF ELECTRICITY: ENERGY AND CAPACITY

The annual demand for electricity in California is roughly 270,000 gigawatt-hours, or an average of 30,800 MW/hr. Because electricity cannot be stored, however, sufficient generation *capacity*, more than 50,000 MW, must exist to meet demand during the hottest hours of the summer, when industrial and commercial consumption is augmented by residential air-conditioning loads. While demand-side programs, designed to reduce consumption during peak hours, and seasonal exchanges (the purchase of surplus energy from the Pacific Northwest) can reduce the need for energy during peak hours in the summer, the fact remains that some power plants in California are needed solely to provide energy for a handful of hours during the year.

Figure C-1
Hourly Profile of California Electric Demand & Supply
One Typical Day for Each Quarter

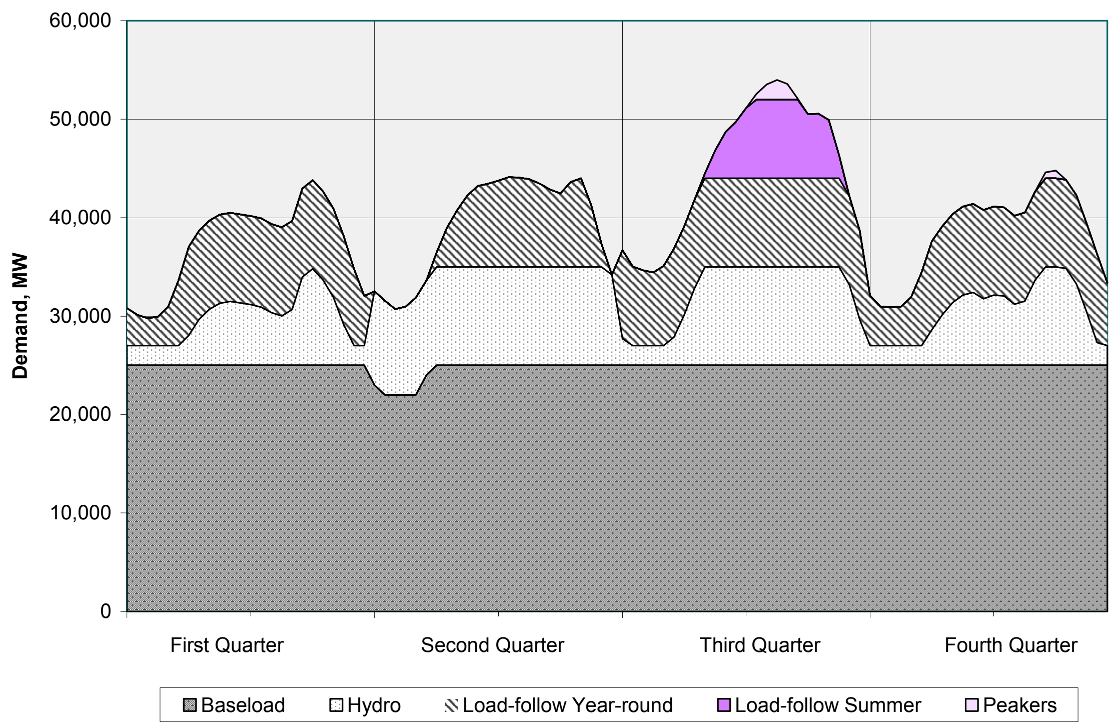

Figure C-1 illustrates the role that different power plants play in meeting California's energy needs. **Baseload** plants run at full output, around the clock, throughout the year. These plants are generally costly to build, but have relatively low fuel costs and are inexpensive to operate once constructed. They include nuclear and coal facilities, many renewable technologies (landfill gas, biomass), gas-fired cogeneration and newer, more efficient gas-fired facilities, such as the large combined-cycle plants built during the past three years. **Load following** units, many of which turn off at night or run at minimum levels when demand is low, increase output during the day as demand increases, then cut production in the early evening as industrial and commercial demand falls.[1] The least efficient of these units will provide this service primarily in the summer, when demand is highest. Finally, **peaking** units may only operate during mid-afternoon in the summer. The least efficient of these may only operate on the very hottest days, perhaps as few as four or five days a year. Surplus generation in neighboring areas and "mild hot temperatures" (*e.g.,* 102 degrees rather than 109 degrees) may result in a peaker plant not being needed at all in some years. These units are relatively inexpensive to construct on a per-MW basis, but very expensive to operate. They require up to 20,000 Btu of natural gas per kilowatt-hour of electricity generated – three times that of a new combined-cycle unit.

All new plants require a sufficient stream of revenue to warrant their construction by a merchant generator, including those that would only operate a few hours per year. If it expects to operate only 80 hours per year (*e.g.,* for 8 hours on each of the 10 hottest days of the year), a typical new plant, requiring revenue of $80/kw-year to compensate investors and repay creditors, would require a price of $1000/MWh during those hours. In the absence of long-term contracts, recent market history shows that peaking plant developers have no guarantee they could sell into the spot energy market at anywhere near that price, nor that they will even have the opportunity to participate in the market in any given year.[2] Given the uncertainty regarding the need for the output, the buyer will not contract to purchase a given amount of **energy** from a peaking plant at a high price, but will instead purchase the plant's **capacity**: the right to purchase the energy upon demand at a much lower price, in exchange for a fixed payment that provides the plant owner with the (certain) revenue that is needed.

Capacity contracts are not only the province of peaking facilities, but often of load-following units as well. We can contrast the uncertainty associated with the demand for power from peaking units with baseload plants. Baseload energy is always needed and available at a relatively low cost, hence utilities are willing to purchase fixed amounts of energy over long periods. The need for and relative cost of energy from load-following units can vary from year to year as hydrology conditions change and as the availability of (cheaper) energy from baseload plants moves from surplus

[1] Hydroelectric generation has both baseload and load-following characteristics. "Run-of-river" generation, that which is produced by unimpeded river flow, meets baseload needs, while the controlled portion, which can be held in reservoirs and released as needed, provides load-following services. The amount of each varies seasonally with rain- and snowfall, and across years due to "wet" and "dry" hydrology conditions. However, some hydro units are mandated to operate as run-of-the-river generation during parts or all of the year to maintain river flows below the dam.
[2] This uncertainty in fact increases the necessary revenue stream. While a merchant generator might willingly settle for $80/kw-year if it were certain, he will require a larger "expected" value if the potential for less revenue is substantial.

to shortage and back again. Accordingly, both buyers and sellers of load-following services may often prefer capacity, rather than energy contracts.